Utility of Operant Conditioning to Address Poverty-Related Health Disparities

Kenneth Silverman

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<table>
<thead>
<tr>
<th>Collaborators</th>
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<tr>
<td><strong>Software Developers</strong></td>
</tr>
<tr>
<td>- Michael Grabinski</td>
</tr>
<tr>
<td>- Leonard Onyiah</td>
</tr>
<tr>
<td>- Bob Collins (iLearn)</td>
</tr>
<tr>
<td><strong>JHU Mentors</strong></td>
</tr>
<tr>
<td>- Maxine L. Stitzer</td>
</tr>
<tr>
<td>- George E. Bigelow</td>
</tr>
<tr>
<td><strong>JHU Faculty</strong></td>
</tr>
<tr>
<td>- Eric C. Strain</td>
</tr>
<tr>
<td>- Dace Svikis</td>
</tr>
<tr>
<td>- Michael Fingerhood</td>
</tr>
<tr>
<td>- Conrad J. Wong</td>
</tr>
<tr>
<td>- Annie Umbricht</td>
</tr>
<tr>
<td>- Sigurdur Sigurdsson</td>
</tr>
<tr>
<td>- Anthony DeFulio</td>
</tr>
<tr>
<td>- August F. Holtyn</td>
</tr>
<tr>
<td>- Robert F. Siliciano</td>
</tr>
<tr>
<td>- Mark A. Marzinke</td>
</tr>
<tr>
<td><strong>Postdoctoral Fellows</strong></td>
</tr>
<tr>
<td>- Elias Robles-Sotelo</td>
</tr>
<tr>
<td>- Jesse Dallery</td>
</tr>
<tr>
<td>- Darlene Crone-Todd</td>
</tr>
<tr>
<td>- Todd W. Knealing</td>
</tr>
<tr>
<td>- Wendy D. Donlin</td>
</tr>
<tr>
<td>- Anthony DeFulio</td>
</tr>
<tr>
<td>- Jeffrey J. Everly</td>
</tr>
<tr>
<td>- Will M. Aklin</td>
</tr>
<tr>
<td>- Kelly E. Dunn</td>
</tr>
<tr>
<td>- Mikhail N. Koffarnus</td>
</tr>
<tr>
<td>- August F. Holtyn</td>
</tr>
<tr>
<td>- Brantley P. Jarvis</td>
</tr>
<tr>
<td>- Shrinidhi Subramaniam</td>
</tr>
<tr>
<td>- Forrest Toegel</td>
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<tr>
<td>- Matthew D. Novak</td>
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</table>
Poverty is Associated with Poor Health

- **Obesity**: Drewnowski et al. (2004). Am J Clin Nutr. 79, 6-16
- **Smoking**: Hiscock et al. (2012). Ann. N. Y. Acad Sci, 1248, 107-123
- **Heart Failure**: Hawkins et al. (2012). Eur J Heart Fail, 14, 138-146
- **Stroke**: Addo et al. (2012). Stroke, 43, 1186-1191
- **Cancer**: Ward et al. (2004). CA Cancer J Clin, 54, 78-93
- **HIV**: Oldenburg et al. (2014). AIDS, 28, 2763-2769

Silverman, Holtyn and Jarvis (2016). Preventive Medicine, 92, 58–61;
Poverty is Associated with Poor Health

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Poverty in the United States and Baltimore

% of Population

United States: 12.7% (N=40,600,000)
Baltimore: 22.1% (N=133,151)
Promoting Health In People Who Live in Poverty

• Proximal interventions:
  – promote health in people who live in poverty

• Distal interventions:
  – reduce poverty

Proximal Intervention: Incentives for Viral Suppression in People Living with HIV
HIV Diagnoses by Poverty

Daily Use of Antiretroviral Medication for HIV

- Viral Load
- Undetectable Threshold

Viral Load (Copies/mL) vs. Consecutive Weeks (1 Year)
Antiretroviral Therapy for HIV

• Improves health and increases lifespan
  – Leone et al., 2011, Infection, 39, 13-20
  – Montaner, Wood et al., 2010 J of AIDS, 55, S5-9

• “Undetectable = Untransmittable”

• Ending the HIV/AIDS epidemic
  – Fauci et al., 2019, JAMA, 321, 844-845.
  – UNAIDS, 2014. 90-90-90

HIV Care Cascade in Baltimore in 2017

Arey et al. (2018). Baltimore Metro Annual HIV Epidemiological Profile 2017
Undetectable Viral Load in Studies Reviewed by Kanters et al.

Kanters et al. (2017). Lancet HIV, 4, e31-e40d
Undetectable Viral Load in Incentive Studies

Toegel et al. (in preparation)
Undetectable Viral Load in Incentive Studies

Toegel et al. (in preparation)
Main Inclusion Criteria

- ≥ 18 years old
- Living with HIV
- Detectable viral load (>200 copies/mL)

Silverman et al. (2019). AIDS and Behavior, 23, 2337–2346
Experimental Design

Silverman et al. (2019). AIDS and Behavior, 23, 2337–2346
Incentive Intervention

- High magnitude incentives ($10 / day)
- Reinforce decreases in viral load (≈30% / wk)
- Random and decreasing viral load testing
- Long-term incentives: 2 Years ($7,300)
- Earnings applied to reloadable credit card

Silverman et al. (2019). *AIDS and Behavior*, 23, 2337–2346
## Demographic Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Usual Care (n=50)</th>
<th>Incentive (n=52)</th>
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</thead>
<tbody>
<tr>
<td>Men</td>
<td>54%</td>
<td>54%</td>
</tr>
<tr>
<td>Black or African American</td>
<td>90%</td>
<td>88%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>76%</td>
<td>86%</td>
</tr>
<tr>
<td>Living in Poverty</td>
<td>82%</td>
<td>83%</td>
</tr>
<tr>
<td>HIV Exposure Category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injection drug use</td>
<td>16%</td>
<td>19%</td>
</tr>
<tr>
<td>Men who have sex with men</td>
<td>14%</td>
<td>15%</td>
</tr>
<tr>
<td>Heterosexual sex</td>
<td>64%</td>
<td>48%</td>
</tr>
</tbody>
</table>

*Silverman et al. (2019). AIDS and Behavior, 23, 2337–2346*
Undetectable Viral Loads During First Year

OR = 15.6
(4.2–58.8)
P < 0.001

Silverman et al. (2019). AIDS and Behavior, 23, 2337–2346
Undetectable Viral Loads During Second Year

Novak et al. (in preparation)
Undetectable Viral Loads Over 2 Years

Novak et al. (in preparation)
Operant Conditioning to Promote Drug Abstinence in People Who Live in Poverty

Injection Drug Use by Income

Proximal Intervention: Abstinence Reinforcement

- **Target**: Drug-Free Urine
- **Consequence**: Money or Privilege

*Bigelow et al. (1981). Addictive Behaviors, 6, 241-252*
Proximal Intervention: Abstinence Reinforcement

- Drug-Negative Urine
- Voucher
- Goods & Services (e.g., shoes)

Abstinence Reinforcement is an Effective Approach

• Meta-Analysis of Psychosocial Treatments

• Review of Cocaine Addiction Treatments

• National Institute on Health and Clinical Excellence (NICE) Review of Psychosocial Interventions

• Review of Interventions for Pregnant Smokers
Reinforcement Magnitude Matters

• Increasing magnitude increases effectiveness
  – Stitzer and Bigelow (1983). Behavior Therapy, 14, 647-656
  – Higgins et al. (2007). Addiction, 102, 271-81
Relapse is Common After Reinforcement Ends

• Alcohol and Benzodiazpines
  – Miller et al. (1974). Behaviour Research and Therapy, 12, 261-263

• Cigarettes
  – Shoptaw et al. (2002). Addiction, 97, 1317-28

• Cocaine

• Heroin
  – Silverman et al. (1996). Drug and Alcohol Dependence, 41, 157-165
  – Preston et al. (2002). Drug and Alcohol Dependence, 67, 125-137
Maintenance of Abstinence Reinforcement

• Long-term maintenance of reinforcement
  – Kirby et al. (2013). Drug and Alcohol Dependence, 132, 639–645
The Therapeutic Workplace: Proximal and Distal Interventions

Silverman, Holtyn and Jarvis (2016). Preventive Medicine, 92, 58–61;
A Laboratory Model of a Therapeutic Workplace

Employment-Based Abstinence Reinforcement

Drug-Free Urine → Work → Wages
Phases of Therapeutic Workplace Treatment

PHASE 1:
Training and Abstinence Initiation

JOB: Training
PAY: Vouchers or Reloadable credit cards
DURATION: Limited

PHASE 2:
Therapeutic Workplace Business

JOB: Work
PAY: Paycheck
DURATION: Unlimited
Therapeutic Workplace Business to Maintain Abstinence

DeFulio et al. (2009). Addiction, 104, 1530-1538
Cocaine Abstinence in Year of Phase 2 Employment

OR = 3.88
(1.69 - 8.88)
P = 0.001

DeFulio et al. (2009). Addiction, 104, 1530-1538
Attendance in Year of Phase 2 Employment

DeFulio et al. (2009). Addiction, 104, 1530-1538
Post-Treatment Cocaine Abstinence

DeFulio et al. (2011). Addiction, 106, 960–967

OR = 4.57 (1.37-15.25)  
P = 0.01

P = NS
Effects of Voucher and Employment Incentives in Addiction

Models to Promote Long-Term Abstinence & Employment

Models to Promote Abstinence and Employment

Phase 1

- Therapeutic Workplace
  - Adult Education & Job-Skills Training

Phase 2

- Social Business
  - Abstinence-Contingent Employment

- Cooperative Employer
  - Abstinence-Contingent Employment

- Wage Supplement
  - Abstinence-Contingent Wage Supplements

Models to Promote Abstinence and Employment

Phase 1
- Therapeutic Workplace
  - Adult Education & Job-Skills Training

Phase 2
- Social Business
  - Abstinence-Contingent Employment
- Cooperative Employer
  - Abstinence-Contingent Employment
- Wage Supplement
  - Abstinence-Contingent Wage Supplements

A Therapeutic Workplace Social Business

Silverman et al. (2005). Behavior Modification, 29, 417-463
Social Business Model: Study Design

- Random Assignment
- Phase 1
  - Therapeutic Workplace (n=20)
- Phase 2
  - Usual Care Control (n=20)
- Center for Addiction & Pregnancy

Silverman et al. (2001, 2002). Experimental and Clinical Psychopharmacology
Aklin et al. (2014). Journal of Substance Abuse Treatment, 47, 329–338
Social Business Model: Abstinence

![Graph showing percent cocaine negative over time for Usual Care Control and Therapeutic Workplace groups.]

*Significant differences indicated by asterisks.*

Silverman et al. (2001, 2002). Experimental and Clinical Psychopharmacology
Aklin et al. (2014). Journal of Substance Abuse Treatment, 47, 329–338
Social Business Model: Employment

Aklin et al. (2014). Journal of Substance Abuse Treatment, 47, 329–338
The Wage Supplement Model

Phase 1

Therapeutic Workplace

Adult Education & Job-Skills Training

Phase 2

Social Business
- Abstinence-Contingent Employment

Cooperative Employer
- Abstinence-Contingent Employment

Wage Supplement
- Abstinence-Contingent Wage Supplements

Wage Supplement Model: Study Design

- Random Assignment
- Abstinence Contingent Work
- Usual Care Control
- Abstinence-Contingent Wage Supplements

Enrolled

Phase 1

Phase 2

Consecutive Months

1 2 3

1 2 3 4 5 6 7 8 9 10 11 12

Holtyn et al (2020). J of Epidemiology and Community Health
### Wage Supplement Model: Participant Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Male</td>
<td>55%</td>
</tr>
<tr>
<td>Black or African American</td>
<td>56%</td>
</tr>
<tr>
<td>Living in Poverty</td>
<td>98%</td>
</tr>
<tr>
<td>Injection Drug Use</td>
<td>46%</td>
</tr>
<tr>
<td>Opiate- or Cocaine-Positive Urine</td>
<td>63%</td>
</tr>
</tbody>
</table>

*N = 91*

_Holtyn et al (2020). J of Epidemiology and Community Health_
Wage Supplement Model: Drug Abstinence

OR=2.3
(1.2-4.3)
p<.01

Holtyn et al (2020). J of Epidemiology and Community Health
Wage Supplement Model: Employment

OR = 3.9
(1.6-9.4)
p < .004

Holtyn et al (2020). J of Epidemiology and Community Health
Wage Supplement Model: Poverty

OR = 3.8
(1.6-9.0)

p < .004

Holtyn et al (2020). J of Epidemiology and Community Health
Hours Worked Per Week and Hourly Pay

The Therapeutic Workplace: Education Focused Intervention to Promote Employment

Limited Skills of Participants - WRAT

Holtyn et al. (2015). J of Vocational Rehabilitation, 42, 67-74
Limitations of Education-Focused Approaches

• Education-focused interventions have failed to retain low income individuals in education.

Incentives in Training & Education

- **Promotes attendance in training**

- **Promotes punctuality and complete work shifts**

- **Promotes productivity and progress in training**

Effects of Stipend-Supported iLearn Math on WRAT

Received iLearn Math Training

Math

P = .0003

Did Not Receive Training in Spelling or Reading

Spelling

P = NS

Reading

P = NS
Addressing Poverty-Related Health Disparities

- Incentives and the Therapeutic Workplace can promote and maintain drug abstinence and medication adherence.

- The Therapeutic Workplace can promote employment and reduce poverty.

- Stipend-supported education may be useful to promote employment in high paying jobs.
Title of Program: VCBH Monthly Lecture Series FY2021

Title of Talk: Utility of Operant Conditioning to Address Poverty-Related Health Disparities

Speaker/Moderator: Kenneth Silverman, PhD

Planning Committee Members: Stephen H. Higgins, PhD, Philip Ades, MD, Diann Gaalema, PhD

Date: November 18, 2020

Workshop #: 21-265-03

Claiming Instructions

Vermont Center on Behavior and Health Monthly Lecture Series FY 2021-
Utility of Operant Conditioning to Address Poverty-Related Health Disparities
11/18/2020

Use the following link to access the claiming app, or scan the QR code below.
Claiming App:

DISCLOSURE:
Is there anything to disclose? ☐ Yes or ☑ No
Please list the Potential Conflict of Interest (if applicable): ——

All Potential Conflicts of Interest have been resolved prior to the start of this program.
☑ Yes or ☐ No (if no, credit will not be awarded for this activity.)
(CMIE staff members do not have any interests to disclose)

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